SELECTED SAGO-BASED TRADITIONAL FOOD OF PAPUA NEW GUINEA

P.A. SOPADE & K.E. KAURI, Food Technology Section, Department of Applied Sciences, Univeristy of Technology, Lae, Papua New Guinea.

ABSTRACT

Sago is a staple food in the coastal flood plains of Papua New Guinea and is prepared in various forms. Eight sago-based traditional food are described here. They were obtained from a survey conducted from 1992 to 1994. These food included Dia, Kalua, Alung, Sago Fomo, Karamap Saksa, Kilikan, Mona Sagu, and Sagu Bamboo, Coconut, banana and peanut are normally combined with sago to improve the nutritional quality. Certain areas for upgrading these food are discussed.

***KEYWORDS**: sago, improve quality, traditional, processing*

INTRODUCTION

Sago, an edible starch extraced from the trunk of the palm *Metroxylon sagu* is a valuable food for many communities in Southern Asia, Melanesian Islands, Micronesia, India, Sri Lanka, and Central and Southern Amerca (Cecil 1992). The area under wild sago palm has been estimated as 2.25 million ha of which about 1 million ha are in Papua New Guinea (PNG) where it is considered to be the centre of diversity for sago (Flach 1997). There are many type of sago palms in PNG and most sago palms are thought to be *Metroxylon rumphii* (Yatsugi 1986), although Shimoda & Power (1992) considered *M. sagu* and *M. rumphii* to be the same species.

Sago is used in almost all the coastal provinces in PNG. The traditional extraction of sago starch is physically demanding (Morauta 1982), a factor that is reducing sago production but emphasising the need to introduced efficient and effective tools. Shimoda & Power (1986) discussed the factors affecting starch content of sago, while Fujii *et al.* (1986) outlined approaches to improve the quality of sago starch. Power (1986) noted that in PNG, research and development efforts are needed to optimise sago starch processing with regard to technology, production and marketing. The success of such efforts will depend on finding uses for the improved sago starch within and beyond the production centre(s).

Two strategies could be adopted for increased utilisation of sago starch in PNG. One is to examine and adapt conventional processing of sago products and to upgrade traditional procedures for the manufacture of sago products (New 1986). However, the upgrading strategy must be aware that traditional food processing is noted for inefficient technology, ignorance of hygienic practices, lack of quality control, and insufficient understanding of the operations and processess involved (Sopade 1995). Although traditional products are relatively easily accepted by consumers, the type of product must be identified so that technology can be applied to its efficient processing. A step in this direction would generate a processing base for an important traditional food.

New (1986) described a range of sago-based food but the approach was more from the cookery standpoint and not particularly adapted for food processing studies. This is because such studies require itemising the unit operations and processes for clearer identification of the critcal steps. This is needed to identify the contributions of the steps to overall quality of the finished product. Such identifications help inventing appropriate machines for increased utilisation of sago starch. Hence, this paper uses flowcharts to describe some of these food and is hoped that more sago-based food or variations in those described will be reported as these long-term studies continue.

METHODOLOGY

A survey was conducted at the Papua New Guinea University of Technology, Lae and some women groups were asked about the traditional food that they were familiar with. Between 1992 and 1998,

new food technology students were asked to describe the traditional food in their provinces. In some cases, personal interviews were conducted before the final flowcharts were formulated.

RESULTS AND DISCUSSION

Traditional Food

The following traditional food were complied.

Dia

Dia is a banana-sago pudding (Figure 1) common in Central Province. The banana improves the nutritional quality of the sago. Storing the pudding in coconut oil is reported to increase its shelf life possibly by providing a barrier between the pudding and air. The moisture content of the pudding is expected to be high and the likelihood of hydrolytic rancidity of the coconut will limit prolonged storage.

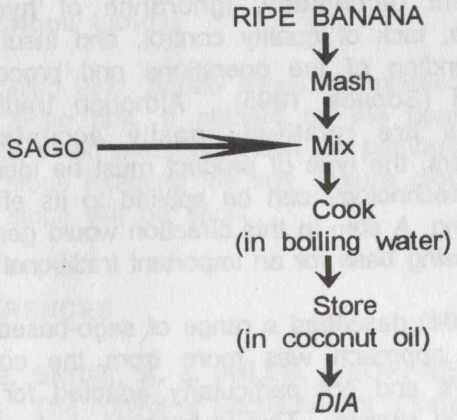

Figure 1. **Preparation of Dia**

Kalua

This is similar to Dia except that grated coconut and fish are added to the pudding (Figure 2). It is not stored in oil and is common in Morobe Province.

Alung

A sago-coconut product (Figure 3) that is dry-fried. Another form of the mixture is cooked in water and served with fish and vegetables. Both products are common in Madang and Morobe Provinces.

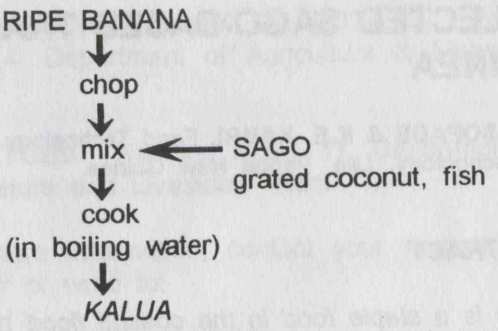

Figure 2. **Preparation of Kalua**

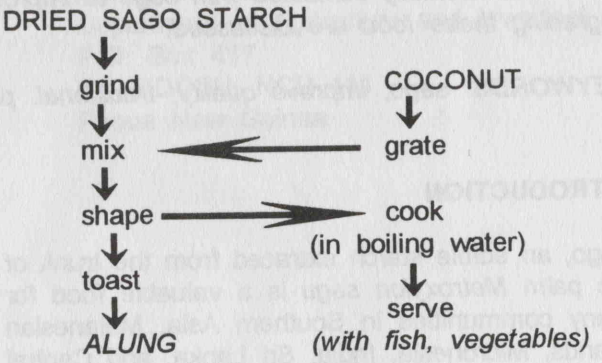

Figure 3. **Preparation of Alung**

Sagu Forno

Sago and water or coconut milk are mixed and roasted in a clay tray known as Forno with depressed compartments (Figure 4). The mixture is put into the Forno after pre-heating the trays. The residual heat in the tray cooks the food. It is popular in East and West Sepik Provinces.

Figure 4. **Preparation of Sagu Forno**

Karamap Saksak

The major raw materials are sago and water or coconut milk (Figure 5) and it figuratively means "wrapped sago". Grated coconut and peanuts may be added. It is usually consumed after the main course and eaten with dry coconut if no grated coconut was added before roasting. It has a short shelf life and is mainly prepared in Madang, Morobe and Sepik Provinces.

Kilikan

This is sago soup with dilute consistency (Figure 6) and is ususally served hot. It is a popular dish in Manus Province.

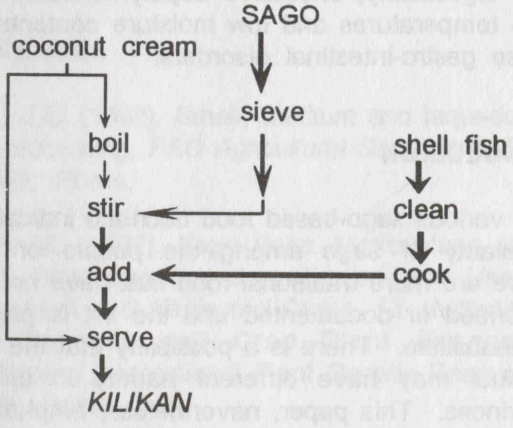

Figure 6. **Preparation of Kilikan**

Mona Sagu

The simplified flow chart is in Figure 7 and is eaten as dessert in the Milne Bay Province.

Sagu Bamboo

This is popular in the Madang Province (Figure 8) and can be eaten with grated coconut.

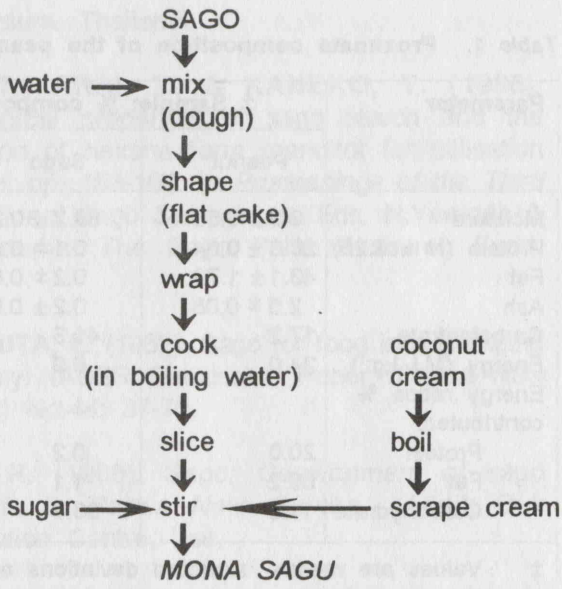

Figure 7. **Preparation of Mona Sagu**

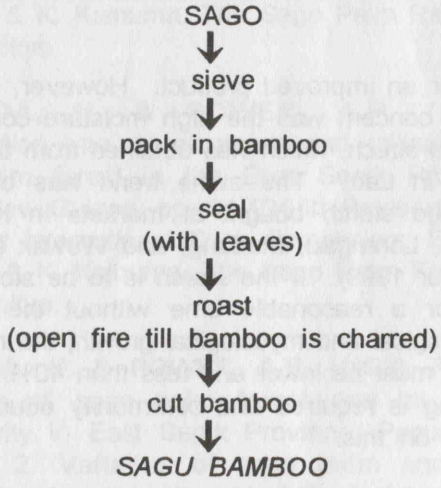

Figure 8. **Preparation of Sagu Bamboo**

STRATEGY FOR UPGRADING

From the above descriptions, it can be observed that sago starch is cooked either dry or wet. Also protein-rich food are traditonally used to increase the nutritional value of the product because sago starch is very low in protein. Using peanut, the protein and energy of the mixtures (Table 1) increased substantially (Sopade & Koyama 1999).

When the mixture was boiled in water and served to tasters in a senory evaluation study, the 30% supplemented mixture was the most desired (Sopade & Koyama 1996). Since peanut is a local product, this observation indicates a possible

Table 1. **Proximate composition of the peanut-supplemented sago samples**

Parameter	‡ Sample: % composition of sago (S) and peanut (P)					
	Peanut	Sago	80S / 20P	70S / 30P	60S / 40P	50S / 50P
Moisture	8.9± 0.53	58.2 ± 0.21	52.1± 0.38	48.4 ± 1.08	37.9 ± 0.34	33.3 ± 0.96
Protein (N x 6.25)	28.3 ± 0.64	0.1± 0.02	8.3 ± 0.76	9.4± 0.86	13.2 ± 1.14	19.1± 0.42
Fat	43.1 ± 1.72	0.2± 0.01	9.5 ± 0.88	10.0 ± 1.31	14.0± 0.74	19.0 ± 2.17
Ash	2.5 ± 0.08	0.2± 0.01	0.8 ± 0.07	1.0 ± 0.09	1.0± 0.11	1.2 ± 0.13
Carbohydrate	17.2	41.3	29.3	31.2	33.9	27.4
Energy (MJ kg^{-1})	24.0	6.9	9.9 (43)†	10.6 (53)	13.2 (90)	15.0 (117)
Energy ratios % contributed:						
Protein	20.0	0.2	14.3	15.2	17.1	21.7
Fat	68.2	1.1	36.6	36.0	40.4	48.2
Carbohydrate	11.8	98.7	49.1	48.8	42.5	30.2

‡ Values are means standard deviations and carbohydrate was obtained by difference.
† Figures in bracket are percent increase relative to the unfortified sample.

Source: Sopade & Koyama (1999).

route for an improved product. However, a major storage concern was the high moisture content of the sago starch, which was obtained from the main market in Lae. The same trend was observed with sago starch bought at markets in Kavieng, Kerema, Lorengau, Madang, and Wewak (Sopade & Kiamur 1999). If the starch is to be stored and used for a reasonable time without the risk of microbilogical and mycological growth, the moisture content must be lower and less than 40%. A form of drying is required and community education is needed on this.

The physico-chemical changes in the sago starch under the various conditions described above in the traditional processing techniques, and in the presence of the diverse ingredeints and concentrations need to be ascertained for quality assurance. The characteristics of sago starch have been summarised by Ito *et al.* (1986), Takahashi (1986) and Gumbira-Sa'id (1994) as;

- easy to gelatinise at 60°C - 82°C,
- easily retrogrades,
- high viscosity,
- easily moulded,
- low syneresis.

From the calorimetric study of Gumbira-Sa'id (1994), it appears that sago starch requires moisture content of not less than 54% for complete gelatinisation although heat induced depolymerisation can occur at lower moisture contents (Sopade 1991). Such a condition, however, requires high temperatures. While gelatinisation aids digestibility, excessive depolymerisation from high temperatures and low moisture contents may cause gastro-intestinal disorders.

CONCLUSION

The various sago-based food decribed indicate the popularity of sago among the people of PNG. There are more traditional food that have not been described or documented and the list is probably inexhaustible. There is a possibility that the same product may have different names in different provinces. This paper, nevertheless, emphasisses the need for a co-ordinated research and information crossflow on sago in PNG. These traditional food need to be identified and prioritised for improvement on a household or community level as a prelude to commercialisation. While conventional sago products could be introduced, there is an enormous potential for tradtional products. Unlike introduced products, traditional products have the great advantage of easy assimilation by the people, who grew up with them.

Although research on sago-based food has been slow to take off, it is hoped that the information

contained in this paper will reopen local and international interests in the uses of sago for food in PNG.

Apart from the above, the authors have initiated studies to critically examine different techniques of sago starch extraction in PNG. Presently, there are many sites on the internet devoted to sago palm and it is expected that a country that holds about 44% of the world area of wild sago palm would accumulate useful information on this staple food.

Readers with relevant information on the processing and uses of sago starch in their communities are encouraged to contact the senior author.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the pioneering works of Mr Tony Power presently with Mobil head Office, Port Moresby and of Mr Rashimah New, Formerly of the Appropirate Technology Development Institute, University of Technology, Lae and those who have contributed to the present understanding of processing and uses of sago starch in PNG.

REFERENCES

CECIL, J.E. (1992). Small, medium and large-scale starch processing. *FAO Agricultural Services Bulletin 98*. FAO, Rome.

FLACH, M. (1997). *Sago Palm.* Metroxylong sagu *Rottb. Promoting the Conservation and Use of Underutilised and Neglected Crops, 13.* Institute of Plant Genetics and Crop Plant Research, Gatersleben / International Plant Genetic Resources Institute, Rome, Italy.

FUJII, S. KISHIHARA, S. & KOMOT, M. (1986). Studies on improvement of sago starch quality. pp. 186-192. In *Proceedings of the Third International Sago Symposium.* Eds. N. Yamada & K. Kainuma. The Sago Palm Research Fund, Tokyo.

GUMBIRA-SA'ID, E. (1994). *Research and development on the utilisation of sago palm in Indonesia with particular discussion on products development at Faculty of Agricultural Technology, Bogor Agricutural University, Indonesia.* Paper presented at the Fourth International Sago Symposium. Thailand.

ITO, T., ARAI, Y. & KANEKO, T. (1986). Rheological properties of sago starch and the formation of hexane form mannitol for utilisation of sago. pp. 153-160. In *Proceedings of the Third International Sago Symposium.* Eds. N.Yamada & K. Kainuma. The Sago Palm Research Fund, Tokyo.

MORAUTA, L. (1982). Sago for food in a changing economy. IASER Discussion Paper (Papua New Guinea) No.44: 37-75.

NEW, R. (1986). *Sago: Development of sago products in Papua New Guinea.* Liklik Buk Information Centre, Lae.

POWERS, A.P. (1986). Strategy for sago development in the East Sepik Province, Papua New Guinea. pp. 105-108. In *Proceedings of the Third International Sago Symposium.* Eds. N. Yamada & K. Kainuma. The Sago Palm Research Fund, Tokyo.

SHIMODA, H. & POWER, A.P. (1986). Investigation into development and utilisation of sago palm forest in the East Sepik Province, Papua New Guinea. pp. 94-104 In *Proceedings of the Third International Sago Symposium.* Eds. N. Yamada & K. Kainuma. The Sago Palm Research Fund, Tokyo.

SHIMODA, H. & POWER, A.P. (1992). Present condition of sago palm forest and its starch productivity in East Sepik Province, Papua New Guinea. 2. Varieties of sago palm and their distribution. *Japanese Journal of Tropical Agriculture (Japan)* 36(3): 227-233.

SOPADE, P.A. (1991). Starch gelatinisation and retrogradation in food systems with special reference to baked goods. pp. 251-262. In *Wheat in Higeria: Production, processing and Utilisation.* Eds. Rayar, A.J.; Kaigama, B.K.,; Olukosi, J.O. & Anaso. Lake Chad Research Institute, Maiduguri, Nigeria.

SOPADE, P.A. (1995). An upgrading strategy for traditional foods of Papua New Guinea. pp. 164-173. In *Proceedings of the Third Asia Pacific Food Analyssis Network Conference*. Manila, Philippines. 22-25 May, 1995.

SOPADE, P.A. & KAIMUR, K. (1999). Application of Peleg's equation in desorption studies of food

systems: A case study with sago (*Metroxylon sagu* Rottb.) starch. *(in press).*

SOPADE, P.A. & KOYAMA, K. (1996). *Rheological characteristics of a sago-based traditional Papua New Guinea food (*Karamap Saksak*) fortified with peanut.* Paper presented at the Sixth International Sago Symposium. Pekanbaru, Indonesia. 9-13 December, 1996.

SOPADE, P.A. & KOYAMA, K. (1999). The effect of fortification with peanut (*Arachis hypogea*) on the relationship between viscosity and rotational speed of *Karamap Saksak*, a sago-based traditional Papua New Guinea food. *New Zealand Food Journal* 29(1): 10-14.

TAKAHASHI, S. (1986). Some useful properties of sago starch in cookery science. pp. 208-216. In *Proceedings of the Third International Sago Symposium.* Eds. N. Yamada & K. Kainuma. The Sago Palm Research Fund, Tokyo.

YATSUGI, T. (1986). Problems of sago starch manufacturing. pp. 201-207. In *Proceedings of the Third International Sago Symposium.* Eds. N. Yamada & K. Kainuma. The Sago Palm Research Fund, Tokyo.